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ABSTRACT

This article provides a detailed discussion of a team approach to building that involves a construction manager, an architect, and a contractor. Bidding methods are outlined; the major components in construction management -- value engineering and fast track scheduling -- and the use of performance specifications are discussed. The construction manager's role is summarized, and a detailed list of the services offered by the author's construction management firm is presented. (MLF)

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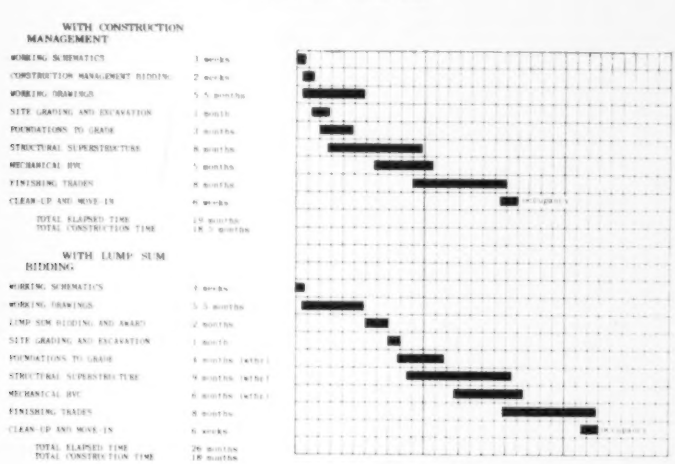
Construction Management

An article entitled "Federal Aid" in the SCUP Journal *for August 1971 made reference to a technique known as construction management and its promotion by the Facilities Engineering and Construction Agency of the Department of Health, Education, and Welfare. To provide our readers with a more detailed discussion of the technique, the* Journal *asked James F. "Red" Abbott, Associate Director, Morgan/Warnecke, Construction Management Consultants, San Francisco, to prepare the following article. Red, then construction and maintenance coordinator for the University of California, applied construction management techniques to the erection of the first building complex completed under the University Residence Building Systems project at UC/San Diego.*



Construction management is not new nor is there an all inclusive definition of the term. There are as many concepts of CM as there are people practicing it. It has been employed in private industry in varying degrees for years, but only recently has it become available for effective use in the public sector.

Public agencies generally have been required to advertise for competitive bids, after completion of working drawings and specifications, and then to accept bids from any contractor able to make bond. The resulting lump-sum bid often was the source of tremendous problems that resulted in many disagreements as to intended scope, interpretation of construction documents, methods of construction, completion time, materials, extras, competence of the general contractor and/or his subcontractors, exploitation of subcontractors by the prime contractor, including bid-shopping, and other frustrations.

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A Team Approach

Through the "team approach," involving the construction manager, architect, and contractor, we achieved maximum economies without sacrificing the safeguards of competitive bidding. All this was accomplished through public advertising for prequalification of interested contractors, followed by solicitation of competitive fee bids from those who were prequalified.

In private industry, it is possible and sometimes desirable for an owner to select one general contractor to do all his building. This has not been possible in the public sector because of the competitive bidding hang-up. In order to overcome this barrier and to help insure that only responsible contractors would be qualified to submit competitive bids, we developed the following method of prequalifying general contractors:

Through an advertisement called a "Notice to Contractors," all interested contractors were invited to submit specific financial, surety, and insurance information on a given date. The information was objectively evaluated on a prequalification evaluation worksheet based solely on the information provided by each contractor and using a previously

established point system. Under this system, a contractor scoring 30 or more points out of a possible 38 points would be prequalified to receive bidding documents. Any contractor scoring less than 30 points would not prequalify. Thus, a contractor would prequalify himself based on information which he had furnished, and the owner would be only the scorekeeper.

After a list of prequalified contractors was established, competitive fee bids were obtained in the following manner:

An "Advertisement for Bids" was published calling for proposals from prequalified contractors in terms of fee percentages, sharing of savings, and cost of pre-construction consultation based on an estimated construction cost set forth in the advertisement. These bids would include the base fee covering work performed by the contractor's own forces and another fee covering work performed by his subcontractors, the cost of his performance bond, workmen's compensation insurance, indirect job labor burden, and shared savings. All these items are highly competitive factors in the contractor's cost of doing business.

The resulting contractors' bids were evaluated on a summary evaluation worksheet, in which each contractor's percentages as bid were converted to a dollar value in order to determine the low bidder. The contractor whose bid showed the lowest net cost to the owner was considered the low bidder and was awarded a construction contract. In the case of the pilot project, the percentage fee bids were converted to a fixed-price fee, thus offering the contractor a further incentive to reduce construction costs without any loss of fee. This same procedure for prequalification and fee bidding could also be used for major subcontractors if warranted. In this case, all subcontractor bidding followed the advertised competitive bidding procedure.

It took some time to obtain legal approval of the University's counsel, but it was obtained and use of the procedure was sanctioned by the Board of Regents. A recent audit by the Department of Finance of the State of California indicated the approach met all state requirements for advertised competitive bidding by a public agency.

Elsewhere, the office of the Texas Attorney General has given tentative approval to its use by the University of Houston. HUD has sanctioned the use of CM in a pilot project at San Diego. DHEW is promoting its use. In its first applications of CM, GSA, employing its own version, in effect has limited the construction manager to the role of general contractor, since he must furnish certain general condition items normal to a contractor's operation and is required to perform some of the field construction work. This requirement would eliminate most architects and consultants unless they sought to participate in a compatible joint venture.

Value Engineering

One of the major components in construction management is value engineering. "Value engineering," or VE, first came into prominence after World War II and was first publicly promulgated by the Corps of Engineers. The Corps wrote VE into many of its contracts, offering the contractor a share in any savings due to changes suggested by the contractor. However, these changes were made after the award of contract, generating complaints from unsuccessful bidding contractors. Often the successful contractor was placed in direct competition with the architect/engineer, since most worthwhile savings involved a change in scope and/or design. This type of VE gradually disappeared and was replaced by a concept of value engineering applied before the award of the contract. VE became a workable tool, employed during the design phase, in which the contractor worked hand in hand with the architect/engineer and not in competition with him, a far more practical approach.

Fast-Track

Another important component of construction management is the time-saving element, which materially shortens the overall design/construct time of the project. Since the contractor is so closely related to the design, he is able to start site work, foundations, and utilities before the working drawings are completed. (The accompanying bar chart contrasts the resulting design/construct time under construction management and that under the usual lump-sum concept.) The old method stretched out project timing in successive phases: programming, planning, working drawings, and, finally, construction. No phase could start before the previous phase had been completed. Under CM, these phases are compressed in a time-saving development. The accompanying chart indicates estimated savings in design/construct time of six months. The actual saving was five months – still a good track record. This compression of valuable time saved the owner added cost of interest on interim financing, months of costly price escalation (which ENR estimates at about one percent a month or, theoretically, $10,000 per month for every $1 million of construction cost). It allowed the owner to occupy the facility at the start of the school semester in September rather than five months later.

There is one other important advantage in the time saving effort. Because construction starts before every detail of the owner's requirements are fully developed and included in the working drawings, some specific needs may be determined at a later date without loss of efficiency or danger of early obsolescence.

Performance Specifications

Another new approach to building in today's market is the use of performance specifications. Here, to cite one example, the contractor is asked to submit his competitive bid for a structural system that meets a specified live load rather than a specification detailing materials and dimensions to be employed. He might be asked to submit an electrical bid that will guarantee a certain level of illumination or so many lighting watts per square foot of building rather than providing a specified number of fixtures as shown on the electrical drawings. This approach assures the owner will obtain the most economical performance from the various components of his building. Under the old lump-sum method, the architect selects the products that he believes are best for a particular job. This means that these materials and methods are frozen into the final working drawings. Often this approach produces bids that exceed the owner's budget, requiring time-consuming redesign and added cost to the architect.

Under traditional bidding arrangements, the contractor enters the project upon completion of the working drawings and has little or no opportunity or incentive to contribute to cost reduction. In order to provide an opportunity for the contractor to participate in such cost reductions, the CM procedure permits the selection of a general contractor and perhaps his major subcontractors early in the design process, while maintaining the safeguards of competitive bidding. These contractors are brought into the team at the start of final design, and they are paid a per diem fee, as bid, to act as consultants to the construction manager and architect. The construction management consultant and the architect, along with the owner, evaluate the various detailed systems going into the building with these experts who are knowledgeable and who know which system will satisfy the owner's requirements as well as the architect's design and still will be the most economical. This not only gives the owner the best for his money, but eliminates the old "adversary" roles of contractor and architect. Instead, they are on the same team, the contractor working with the architect during design, providing a necessary balance between architect and contractor without diluting the basic responsibility of either. By providing adequate business management and technical coordination for this new partnership and by using the expertise and know-how of his staff, the construction management consultant can avoid many costly mistakes.

The construction manager functions as the owner's agent, joining the architect, and the contractors in a team working together from design through construction to serve the owner's best interest. The CM is a consultant to the building team and will suggest economies, comment on feasibility, prepare cost estimates and time schedules, determine the best way to award subcontracts, prepare and evaluate the contractors' prequalification bids and fee-bid proposals, schedule and coordinate the purchase of long-lead items, supervise construction, inspect and coordinate both on-site and factory work, schedule meetings, process progress payments and change orders, aid in settling disputes, and even set up maintenance procedures after occupancy.

Typical CM Services

To provide a greater understanding of the construction manager's role, the following list details the services offered by one such firm (my own):

- Assist the owner in selecting the architect and/or general contractor.
- Cooperate with the architect in the preparation of a budget estimate broken down to show the primary elements of project cost.
- Prepare documents for use in prequalifying general contractors by publicly advertised invitations.
- Conduct a pre-bid conference for interested contractors, explaining construction management; supervise the prequalification bidding; evaluate the responses; submit a list of recommended prequalified contractors to the owner.
- Employ these same procedures in prequalifying major subcontractors.
- With the assistance of the architect, prepare documents seeking percentage fee bids on the general contractor's work with his own forces; on subcontractors' work; on the general contractor's indirect job labor burden; on dollar cost of performance bond; on the cost of general contractor's workmen's compensation insurance; on the ratio of contractor/owner shared savings; and on contractor's per diem charge for consulting during the design phase.
- Evaluate fee bids obtained to determine the actual low bidder and make recommendation to owner for award of contract.
- After contract award, bring contractor and architect together for periodic consultation and

review of value engineering during preparation of working drawings; make periodic estimates of cost to keep design within budget; prepare a realistic progress schedule acceptable to owner and contractor.

- When pre-construction estimate is within budget, have the architect proceed with completion of site, foundation, and other appropriate working drawings and, with owner's approval, have the contractor obtain sealed competitive sub-bids for this work.
- After review, recommend owner approval and award of subcontracts by the general contractor.
- Continue review of value engineering and costs with architect and contractor after construction starts and during completion of working drawings.
- As construction documents for the different trades are completed, the contractor will obtain sealed competitive sub-bids and, after review by the construction manager and with owner's concurrence, will award subcontracts.
- When working drawings near completion, the contractor will convert his previous cost estimates into a guaranteed outside price (GOP) based on competitive sub-bids. The price shall be maintained during construction, except as revised by change orders authorized by the owner.
- When competitive sub-bids fall within the GOP, the contractor, with approval of the owner, will award these subcontracts and the balance of the construction will proceed as in a lump sum job.
- During construction, the construction manager will provide the full-time services of a field representative and will report progress and cost reviews regularly to the owner and keep all members of the team fully informed of project progress.
- All change orders will be reviewed with the architect and owner during construction, and a final evaluation report will be made to the owner upon completion of the project.
- If the owner desires, the construction manager will prepare an outline of maintenance procedure to be followed by the owner after occupancy.

There are a number of advantages, not alluded to earlier, in this approach to construction management:

- The contractor, because of his involvement in the working drawing/design stage and thorough familiarity with final plans and specifications and detailed materials and construction methods requirements, is in a position to help avoid delays and extras and assure occupancy on the scheduled date.
- The contractor's allowances for overhead and profit are reduced because his risk is minimized.
- Errors in contractor bidding are virtually eliminated, since the hectic, last minute, hazardous, and chaotic process of putting together a lump-sum bid is avoided.
- Fair and open competition in the selection of the general contractor and all of his subcontractors is insured.
- The approach eliminates "bid shopping," since all sub-bids are received in written and sealed form and are opened in the presence of the owner, architect, construction manager, and general contractor. No phone bids are accepted.
- Better sub-bids are received because all subcontractors submit bids to only one, already selected contractor. Subcontractors thus are encouraged to put more effort into their bids, offering more competitive but still realistic prices.
- Only one general contractor is required to go to the expense of preparing a detailed cost estimate.
- Built-in "value engineering" is provided during both the design and construction phases, insuring that aesthetic requirements are met but in the most economical fashion.
- Realistic scheduling of long-lead items such as structural steel, mechanical and electrical equipment, elevators, and escalators. Where the market warrants, greater cost savings can be realized through advance purchasing.
- Contractor borrowing is minimized, thus reducing overall costs.
- The contractor can be encouraged to further reduce project costs through an option permitting him to convert his percentage fee, as bid, to a fixed dollar amount. The fixed amount would not be reduced by any project savings achieved by the contractor but would be adjusted upward if the scope of work increases.

The construction management procedure and the advantages attributed to it in this article represent more than theory and hopeful projections. Both have been proven in a pilot housing project at the University of California in San Diego, which is near completion. Fees quoted by the successful contractor came in 3 per cent lower than fees included in a lump-sum bid by the same contractor on a similar project at the same campus several years earlier. Considerable savings were realized through value engineering during the design phase and value engineering during construction produced more than $20,000 in *credit* change orders. And, construction management cut project time by five months, permitting occupancy this fall rather than next year.